

EFFECTS OF A HIGH-PRESSURE TREATMENT ON THE PHYSICAL PROPERTIES AND PALATABILITY OF PORK LOIN

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Abstract—this study examined the kinetic property such as the texture using the technique called high-pressure treatment, and its the palatability by sensory evaluation about the quality of meat which is easy to eat. Using pork loin, factors such as the weight reduction and hardness were measured as regards to the influence of the NaHCO₃ treatment and the high-pressure processing. Furthermore, a sensory evaluation of the ease of eating was performed. After soaking, treating with NaHCO₃ and subjecting to a high-pressure treatment cooked meat samples, the weight reduction and hardness decreased with increasing pressure for every meat sample. A sensory evaluation showed that the meat, which had been subjected to high-pressure processing (400 MPa) after the NaHCO₃ treatment (0.4 M) had a good taste, was tender, easy to chew and swallow, and little remained in the mouth. After heating, the contents of free amino acids extracted from the meat which had been subjected to high-pressure processing after the NaHCO₃ treatment were greater than that of the others.

Index Terms: free amino acids, high-pressure treatment, sensory evaluation, sodium hydrogen carbonate (NaHCO₃)

I. INTRODUCTION

During the past decade, consumer demand for convenient, fresh-like safe, high-quality food products has grown. The food industry has responded by applying a number of new technologies including high hydrostatic pressure for food processing and preservation (Hendrickx & Knorr, 2001). As the high pressure processing provides a new methods of avoiding off-flavor and deterioration of food componets and nutrients, producing unique texture on food, saving total amounts of energy required for food processing, the high pressure processing attracted the attention of food industry in Japan (Suzuki, 2002).

Meat is an important food of major dietary source of energy and contains high-quality protein. However, it is considered not to be safe to eat without heating. So meat needs to be cooked. Generally the meat cooked by heating is tough and hard to eat.

In this study, the combined effects of high pressure and NaHCO₃ treatments on the physical property such as the texture of the meat were investigated. Sensory evaluation of the palatability, that is, the quality of meat acceptable for eat, was also examined. The changes in the constituent of the umami taste with the function of the heat treatment after the NaHCO₃ treatment and high-pressure treatment were also investigated .

II. MATERIALS AND METHODS

Part of pork loin was used as meat sample. The pork loin was equally quadrisectioned and immediately frozen at -80°C overnight and then stored at -20°C . Thereafter, the meat was thawed out at 5°C . Half thawing meat after removing fat was trimmed a thickness of 1 cm paralleling with the fiber. And then the meat samples were put in vacuum-sealed polyethylene bag with 0.4 M NaHCO_3 or de-ionized water (non-softened sample) in the soaking solution. The meat samples were sealed and soaked in a water bath of 20°C for 40 min. After that, it was taken out of soaking solution and each meat sample was vacuum-sealed in polyethylene bag again. Meat samples were transferred into each larger polyethylene bag and they were filled with water. Each bag was pressurized at 100, 200, 400 MPa for 10 min at 20°C by high-pressure apparatus. After the pressurization, each meat sample was heated for 30 min at 80°C and cooled down in ice cold water until the central temperature of the meat becomes 20°C .

III. RESULTS AND DISCUSSION

The hardness and weight reduction of cooked meat samples with non-softened treatment and NaHCO_3 -treatment after the pressurization, are shown in Fig. 1 and Table 1 respectively. The meat sample group with NaHCO_3 -treatment was significantly softer (Fig. 1) with less weight reduction (Table 1) in comparison with the non-softened treated group. As processing pressure is higher, the hardness and weight reduction of each meat sample decreased. Specially, the influence of high pressure processing is notably shown with the pressure processing at 400 MPa.

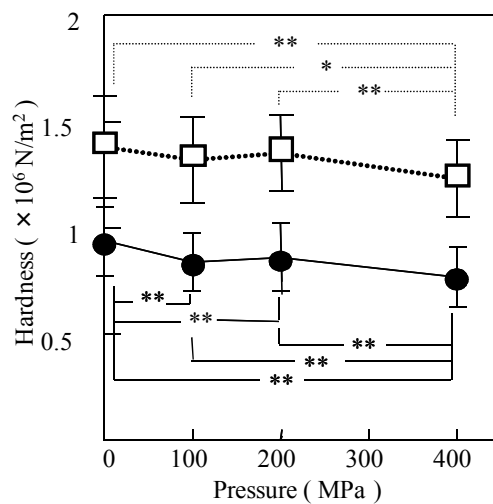


Fig. 1. Effect of high pressure treatment on the hardness of cooked meat samples

□: Non softened treatment, ●: NaHCO_3 treatment. Each value is the mean \pm SD of different samples, *significant difference at $p < 0.05$ and **significant difference at $p < 0.01$.

Table 1. Effect of high pressure treatment on the weight reduction of cooked meat samples

Pressure MPa	Non-softened treatment		NaHCO_3 -treatment	
	%	Significance	%	Significance
0.1	33.37 \pm 1.40		19.14 \pm 1.58	
100	30.24 \pm 0.63		18.94 \pm 2.15	
200	29.56 \pm 1.16		17.78 \pm 2.12	
400	27.33 \pm 0.49		17.01 \pm 2.63	

Each value is the mean \pm SD of 6 different samples, *significant difference at $p < 0.05$ and **significant difference at $p < 0.01$.

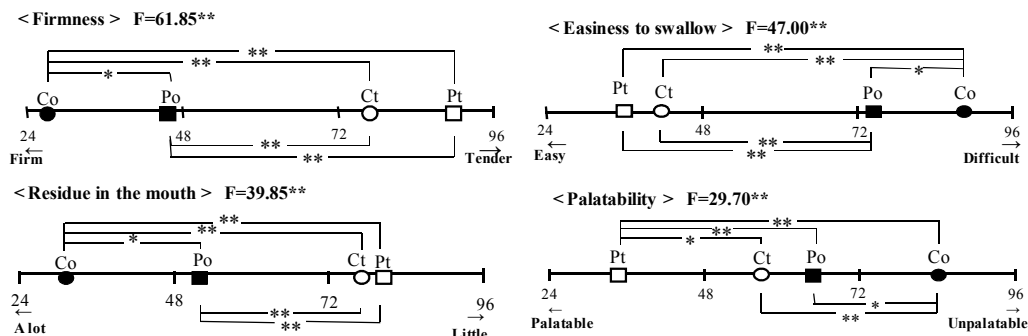


Fig. 2. Distance scale for sensory evaluation of cooked meat samples obtained from the rank order testing
 ●Co: the cooked meat of non-softened and non high-pressure treatment, ○Ct: the cooked meat of non high-pressure treatment after the NaHCO₃ treatment, ■Po: the cooked meat of non-softened and high-pressure treatment, □Pt: the cooked meat of high-pressure treatment after the NaHCO₃ treatment. Each value is the mean ±SD of 24 different samples, *significant difference at p <0.05 and **significant difference at p <0.01.

The result of the sensory evaluation of cooked meat samples carried out by ranking order testing, are shown in Fig. 2. The cooked meat of non-softened and non high-pressure treatment (Co) was recognized to be significantly firm, difficult to swallow, unpalatable and had a lot residue in the mouth, compared with other sample meats. And the cooked meat of high-pressure treatment after the NaHCO₃ treatment (Pt) was recognized to be significantly tender, easy to swallow and had a little residue in the mouth, compared with other sample meats. Specially, in the item of palatability, Pt sample meat was significantly palatable in contrast with three other samples.

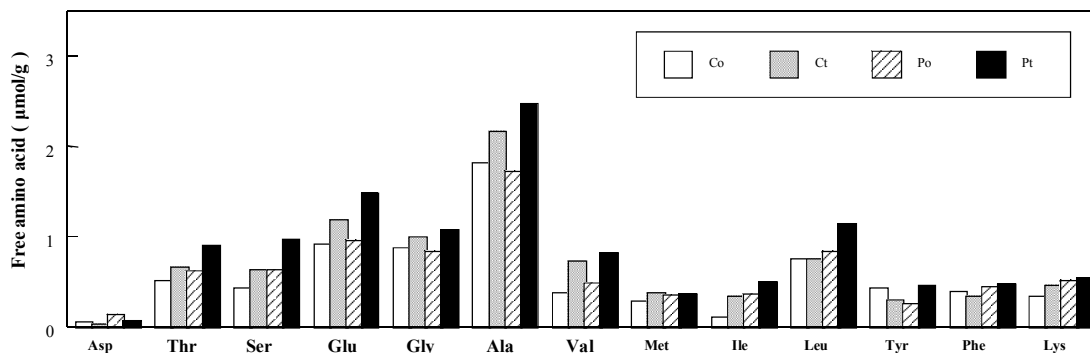


Fig. 3 The contents of free amino acids, extracted from NaHCO₃ and non-softened treatment cooked meat after pressurization
 Co : the cooked meat of non-softened and non high-pressure treatment, Ct : the cooked meat of non high-pressure treatment after the NaHCO₃ treatment, Po: the cooked meat of non-softened and high-pressure treatment, Pt : the cooked meat of high-pressure treatment after the NaHCO₃ treatment.

The contents of free amino acids, extracted from the NaHCO₃-treated meat and non-softened cooked meat after the pressurization, are shown in Fig. 3. After heating, the contents of free amino acids extracted from meat sample by the NaHCO₃ treatment (Ct) were greater than that with non-softened treatment. Specially the contents of free amino acids extracted from the cooked meat (Pt) which had been subjected to high-pressure processing after the NaHCO₃ treatment was greater than that of the others.

IV. CONCLUSION

From these results, it can be said that the meat with NaHCO₃ treatment and high-pressure treatment will do much to develop of food processing.

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